# KSC facilities:

## *Last (Earth) stop for space station components*

Some very special items are making final stops for processing and checkout at Kennedy Space Center before being launched to begin orbital life as parts of the International Space Station.

Those stops are at KSC's Space Station Processing Facility (SSPF) and the Operations & Checkout (O&C) Building.

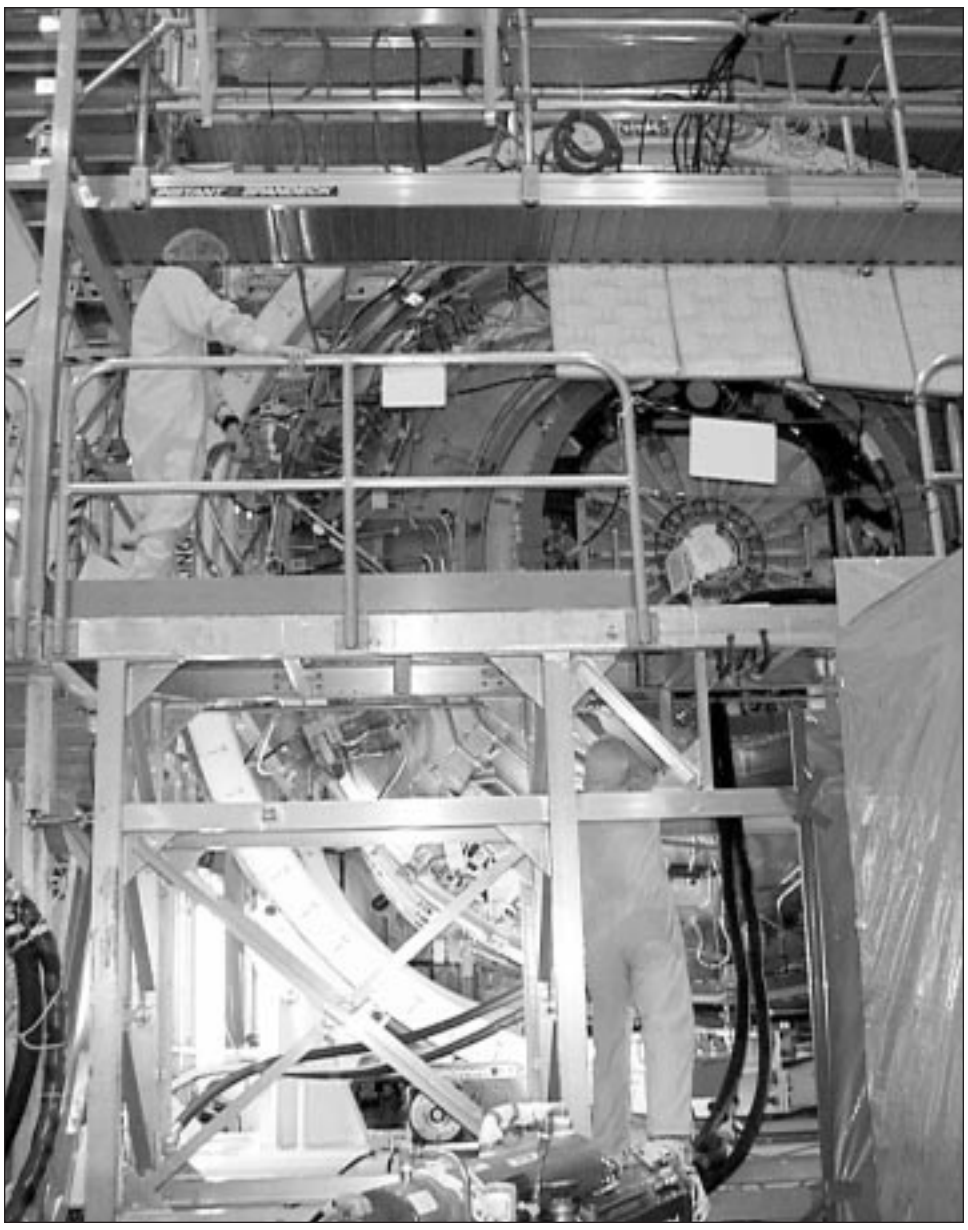
The three-story, 457,000-square-foot SSPF is in KSC's industrial area. It includes two processing bays, an airlock, operational control rooms, and laboratories for non-hazardous station and shuttle payloads. Pressurized and some non-pressurized ISS elements are undergoing assembly and testing there. The SSPF also boasts logistics areas, office space, and a cafeteria.

The five-story, 605,000-square-foot O&C Bldg. contains laboratories, astronaut quarters and hardware processing areas. Previously used in the Spacelab program, it has been converted to support ISS operations. It will host assembly and testing of most of the station truss elements.

When ready for launch, ISS elements will be transported from the SSPF to the launch pad, via the payload transfer canister, for installation into the Orbiter.

Engineers and technicians from NASA, Boeing, the European Space Agency, the National Space Development Agency of Japan, the Canadian Space Agency, the Russian Space Agency and firms in other station partner nations work together to prepare station hardware for launch aboard the space shuttle.

"We have a lot of experience at the Cape when it comes to testing and processing payloads," said Joe Delai, NASA payload processing/testing engineer for the Space Station Hardware Integration Office at KSC. "So one of our goals is to get the station hardware here early, take off our badges, and work together as a team to get the job done. There is no NASA, no Boeing. We all work together to get the job done. This has worked out tremendously."



**Technicians prepare Destiny for acoustic testing. Nearing its final stages of completion, the U.S. lab next will get outfitted with Kevlar and aluminum debris shielding.**

The 300-foot girder-like truss will house critical electronic equipment, including gyroscope systems that eventually will replace thrusters to maintain the station's stability as well as communications equipment.

"The basic purpose of the station truss system is to serve as a support structure for the power segment," said Ben Jimenea, NASA truss test and project engineer at KSC. "It provides a support structure for all of the power cables of the International Space Station – the radiators and the solar arrays."

When new truss segments are added to the ISS, ready-to-latch indicators show astronauts that the next segment is ready to be attached. Once the truss elements are mated, the space-walking astronauts will connect the electrical and fluids lines.

Undergoing tests in the SSPF are Leonardo and Raffaello, identical pressurized Multi-Purpose Logistics Modules (MPLMs) that will serve as the space station's "moving vans," carrying laboratory racks filled with equipment, experiments and supplies to and from the station aboard the space shuttle.

The reusable modules will function as cargo carriers and space station modules. Mounted in the space shuttle's cargo bay for launch and landing, they will be berthed to the station using the shuttle's robotic arm after the shuttle has docked.

The logistics modules also include some life support, fire detection and suppression, electrical distribution and computer equipment. Built in Italy, they are owned by the U.S. and were provided in exchange for Italian access to U.S. research time on the station.

Each cylindrical MPLM is 22 feet long by 15 feet wide. Each weighs about 9,000 pounds and can carry 20,000 pounds of cargo. Leonardo was delivered to KSC in August 1998 and will be launched on shuttle mission STS-102 with equipment and supplies for the U.S. laboratory module. Raffaello arrived at KSC in the summer of 1999. It is scheduled for launch aboard space shuttle mission STS-100. The third, Donatello, should arrive at KSC in October.

With some station elements already on orbit and others still on the ground, engineers had to devise a way to ensure that when things like fluid lines and cables are mated on orbit, they will fit and work. Engineers and technicians designed mock-ups of these elements called test aids, high-fidelity representations of station elements already on orbit to which flight elements still on the ground can be connected.

# Reborn vacuum chamber to test space station parts

**View of inside the vacuum chamber**

A vacuum chamber once used to check Apollo spacecraft for leaks will do similar tests on International Space Station components.

The two vacuum chambers in the Operations & Checkout Building at Kennedy Space Center date back to the Apollo era. The right chamber was used to perform leak tests on the Apollo Command and Service Modules, while the left one was used for the Lunar Excursion Module. The chambers simulated up to an altitude of 250,000 feet.

After 1975, following the conclusion of the Apollo-Soyuz Test Project, the chambers were almost removed in favor of additional storage and processing space. Designation as a national archive saved them, but the vacuum pumps were removed in 1985.

Early in the 1990s, NASA looked into the possibility of using the Russian Soyuz as an Assured Crew Return Vehicle for the space station. The Russians have always used vacuum chambers for their space hardware to do leak tests to verify pressure integrity and produce leakage rates. So they approached NASA with the idea of reactivating one of the vacuum chambers to test the Soyuz modules. But that idea went away with the demise of the Space Station *Freedom* Program.

Once the Russians were brought on board for the ISS Program, they asked how pressurized station elements would be leak checked. In 1997, funding was raised to reactivate one of the altitude chambers.

The right chamber was refurbished in 1998 with all new equipment. Its pumps are computer controlled. It can be pressurized with helium in about 6 1/2 hours to do gross leak checks. It now performs very close to its original performance during the Apollo era and meets the space station requirement for leak checking elements.

But there was one problem: station elements are processed horizontally, but the chamber is vertical – a requirement from the Apollo project. So technicians had to have the capability to rotate the elements to be able to put them into the chamber vertically.

Each station payload to be tested is picked up with a 2-crane lift, rotated to the vertical position, raised above the chamber and lowered into it. Once it is bolted inside the chamber, the payload is derigged and the 27-ton lid is placed on top of the stainless steel chamber so testing can begin.

Five U.S. station elements (Destiny, airlock, Nodes 2 and 3, and the propulsion module) are to be tested in the chamber. The Science Power Platform, a Russian element that will be launched on the space shuttle, and the Columbus Orbital Facility also may be tested in the chamber.

Boeing will test the U.S. elements. Negotiations continue with the Russians and the Europeans about testing of their elements. ■